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5 REDIRECTING OF CALLS TO AVOID NETWORK INTERWORKING BETWEEN  
FIXED NETWORK AND RADIO COMMUNICATIONS NETWORK

FIELD OF THE INVENTION

The present invention relates to a method and a device for cost-effective redirecting of calls. In particular, it relates 10 to the field of call redirecting/call forwarding of incoming calls within differently structured communication networks, as is the case between fixed networks and radio communications networks having mobile radio communications terminals.

BACKGROUND INFORMATION

15 A multitude of solutions is available for call forwarding. German patent reference DE 100 59 327, for example, appears to describe a device and a method for forwarding messages to terminals of different communications media, in order to achieve the ability to reach a subscriber in a switch between 20 a plurality of terminals, including both fixed and mobile terminals. Among the mobile terminals are mobile telephones as well. The reference involves a telecommunications device having a database, which includes subscriber-specific information about the number of target subscribers and 25 terminals assigned thereto, and message formats compatible with these terminals. The control of the processes is implemented via a corresponding control device. Upon receipt of a message for a target subscriber, the control device utilizes the subscriber-specific information to select one or 30 a plurality of terminal(s) via which the target subscriber is able to be reached, converts the message with the aid of conversion modules, and forwards it to the selected terminals for transmission.

In this approach, calls from the fixed network as well as calls from the mobile radio communications network are forwarded to the terminals specified by the subscriber-specific information.

5 This approach focuses on the ability of reaching the subscriber during a switch between a plurality of terminals that may be of different type. Savings in connection with the fees of network interworking or costs resulting from the rate structures of the communication networks themselves, are not  
10 the subject of the solution.

German patent reference DE 199 15 548 A1 describes a method for combining fixed network and mobile communications network telephony. This solution appears based on at least one home location source, a fixed network, and a mobile telephony  
15 network. The subscriber has a dual-mode terminal, which operates both in radio network operation and in cordless mode. The subscriber can be reached and respond at one number, via a single terminal having automatic network selection.

In addition, German patent reference DE 198 10 797 appears to  
20 describe a network-crossing mobility management for multi-range terminals. To control the network-crossing reachability of a multi-range terminal having a mobile line and a fixed network line, the multi-range terminal transmits to the mobile radio communications network a mobile-network cancellation  
25 message when entering the service area of the fixed network, or a mobile-network inscription message when leaving it. In the home location register of the mobile radio communications network, this sets, or cancels, reachability information that indicates the reachability of the multi-range terminal on the  
30 fixed network. In a connection request, a query to the home location register takes place. Depending on the reachability

information, the call is routed to the mobile radio network or to the fixed network line of the multi-range terminal.

In this approach, calls from the fixed network and calls from the mobile radio network are both forwarded as a function of 5 reachability information. Here, too, the focus is not on network interworking fees or network rates.

German patent reference DE 102 15 318 A1 appears to describe a method and a device for coupling mobile radio communications technology and fixed network communications technology, a 10 mobile radio terminal dialing an add-on device integrated in the fixed network via a mobile communications network and checking the access authorization of the caller. If the result of the access authorization is positive, line enabling and thus release of a fixed network line takes place. The desired 15 subscriber telephone number is then input from the radio communications network, from the mobile radio communication device directly, or indirectly via an add-on device, and dialed by the add-on device.

This is designed for telephone calls from the mobile radio 20 communications network to the fixed network and is meant to allow the utilization of advantageous mobile radio communications rates as well as fixed network rates.

German patent reference DE 198 56 269 A1 appears to describe a method for call forwarding of a call made from a first 25 subscriber station to a second subscriber station in the public network. The telephone number of the first subscriber station, or a corresponding identification, is transmitted to the second subscriber station where it is routed to a call forwarding memory. With the aid of a call service or data 30 service, the telephone number or the corresponding identification and/or a callback message are/is forwarded to a call service subscriber or a call forwarding location assigned

to the second subscriber station as a function of a target address stored in the call forwarding memory. After receipt of the telephone number identification, the call service subscriber may decide whether to return the call of the calling subscriber station.

Only the telephone number or the caller identification is forwarded in this approach. A connection that is subject to a fee is not established at this stage. No automatic additional fees for redirecting the call arise.

It is up to the called subscriber to decide whether he wants to provide the calling subscriber with a callback message or whether he will return the call of the calling subscriber.

All solutions have in common that they actually save money. However, they do not explicitly focus on saving network interworking fees within the sense of the approach according to the present invention.

#### SUMMARY OF THE INVENTION

Embodiments of the present invention involve saving network interworking fees that are charged when crossing over from one communication network to another communication network, or to reduce such costs to the greatest extent possible. The basic problem arising in this context is that the savings potential is largely a function of the subscriber since, initially, only the subscriber has knowledge of his location.

In addition to saving network interworking fees, as they occur in the crossover from a fixed network to a mobile communications network, for instance, a simultaneous solution is to be found that motivates the subscriber to forward information of his location, for example, so as to allow calls that arrive via the fixed network to remain on the fixed network, or to allow calls that arrive via a radio

communications network to remain on the radio communications network.

In embodiments of the present invention, many subscribers are able to be reached on more than one network, and that many calls in which the subscriber dials a radio communications telephone network number via a fixed network line, are also quite easily conductable via the fixed network exclusively, provided the subscriber

- a) is located in the vicinity of a fixed network line assigned to him; and
- b) the redirecting of the radio communications network telephone number dialed on the fixed network to a fixed network number assigned to the subscriber is allowed.

The same also applies in the reverse to calls in which a subscriber dials a fixed network telephone number via a radio communications network telephone number. However, this variant is useful only if the cost structures on both networks are substantially similar.

In embodiments of the present invention, under certain conditions, a subscriber B may keep his incoming calls that originate from a fixed network line of a subscriber A, but are destined for a radio communications network line of subscriber B, on the fixed network; and to forward calls that arrive from radio communications network telephone numbers FNB and are destined for a fixed network terminal, to a radio communications network terminal of intended subscriber B, so that the call will remain within the radio communications network.

For additional motivation, subscriber B receives a share of the saved network interworking costs in the form of a bonus.

Since the solution is based on the same operating principle for both the radio communications network and the fixed network, only the case in which the call originates from a fixed network terminal will be elucidated in greater detail below.

Embodiments of the present invention may involve redirecting calls arriving from the fixed network and intended for a radio communications network telephone number FNB of subscriber B, to a fixed network line of subscriber B as a function of the location, in accordance with principles of call redirecting/call forwarding known per se. In every successful setup of a connection in which the communication is conducted exclusively via the fixed network, subscriber B receives a credit for redirecting the incoming call to the telephone number of his fixed network line. The credit is derived from the network interworking costs that were saved by the communication connection between subscriber A and subscriber B not being carried out via two differently structured communication networks, as intended by subscriber A, but exclusively via a single communication network. The credit is credited to subscriber B in the telephone bill for his fixed network line.

However, the call redirecting to a fixed network telephone number of subscriber B, for instance, is useful only if subscriber B is actually staying in the vicinity of the corresponding fixed network line. In most cases, this will be a home telephone line of subscriber B. The telephone number of subscriber B's home line will be denoted by home number HNB in the following text. The efficiency of the approach may be increased by incorporating at least one second fixed network

telephone number of subscriber B into the method, which will be denoted by partner number PNB in the following text.

Partner number PNB is provided to redirect an incoming call to an alternative location of subscriber B. This may be, for 5 example, a fixed network terminal at the workplace of subscriber B. The credit continues to accrue to home number HNB of subscriber B even if the particular call is redirected to partner number PNB.

Embodiments of the present invention may be realized via a 10 service platform of a provider which has implemented a corresponding service feature or a corresponding service on its service platform INP.

On service platform INP, all radio communications network telephone numbers FNB and fixed network telephone numbers of 15 respective subscriber B that are eligible for the service are recorded in a service-specific database and provided with a corresponding assignment.

Every radio communications network telephone number FNB and every fixed network telephone number must be used no more than 20 once. This means that a fixed network telephone number that is used as home number HNB is eliminated as partner number PNB.

There is a 1:1 relation between radio communications network telephone number FNB and the fixed network telephone number with respect to radio communications network telephone number 25 FNB and home number HNB, and with respect to radio communications network telephone number FNB and partner number PNB.

With the aid of this relation, it is always possible to use one of the three telephone numbers to determine the other two 30 telephone numbers.

In a registration process subscriber B must provide the service provider with home number HNB, partner number PNB and radio communications network telephone number FNB. However, setting up a partner telephone number PNB may also be

5 optional.

The service may be activated as a function of the particular terminal used, with the aid of a control call triggered by an already registered subscriber, either via a service telephone number assigned to the fixed network, or via a service

10 telephone number assigned to the radio communications network.

Using the service telephone number in combination with the source number from which the control call is placed, subscriber B determines radio communications network telephone number FNB, home number HNB and partner number PNB to which calls originating from the fixed network and intended for a radio communications network telephone number FNB of subscriber B are to be routed. From the fixed network, service platform INP is supplied with information about all calls to radio communications network telephone numbers. Service

20 platform INP ensures that, until notified otherwise, all further calls that originate from the fixed network and are destined for a radio communications network telephone number

FNB of subscriber B remain in the fixed network and are redirected to the fixed network line (home number HNB or partner number PNB), or are routed to the radio communications network telephone line as set up by the most recent control call.

To facilitate the switchover for the subscriber, a switchover device, which is configured in the form of a cradle having a storage depression, may be situated at the location of the home and/or partner line. The cradle accommodates a radio communications terminal such as a mobile telephone. There is a switch element in the storage depression, which is triggered

when the mobile telephone is placed in the storage depression. The actuation of the switch element activates a call to a service telephone number, which effects the redirection of the radio communication network calls arriving from the fixed network, to the terminal of the fixed network line in whose vicinity the switchover device is located. If the mobile telephone is removed again from the storage depression of the switchover device, renewed actuation of the switch element activates a control call to a second service number, and the switchover function is revoked again.

Another embodiment involves equipping the designated fixed network terminal with a detector, which detects the presence of the radio communications network telephone terminal.

In a further embodiment, if the detector detects the presence of the radio communications network terminal, automatic call redirecting to the individual fixed network terminal to which the detector is assigned is implemented according to the principle already elucidated in connection with the switchover device. The call redirecting will be cancelled again when the detector no longer detects the presence of the radio communications network terminal.

#### BRIEF DESCRIPTION OF THE DRAWING

Fig. 1 shows an exemplary embodiment for a service implemented on a service platform INP.

#### DETAILED DESCRIPTION

Fig. 1 shows an exemplary embodiment for the implementation of the design approach on a service platform of a service provider in intelligent network INP.

Service platform INP illustrated in Fig. 1 shows both the subscribers registered for the service with their respective

telephone numbers such as radio communications network telephone number FNB, home number HNB and partner number PNB, and, to the extent that a restriction of the service to source and target lines within a specific network is required, the affiliation of telephone numbers with certain networks.

The following table 1 illustrates in which way the customers participating in the service are mapped on service platform INP. No double entries are permitted in the fields of radio communications network telephone number FNB, home number HNB and partner number PNB. A number that is used as home number HNB cannot simultaneously be used as partner number, and vice versa.

Table 1

Radio communications network telephone number FNB	radio communications network telephone number to be redirected to the fixed network, if appropriate
status	Indicates how the customer wants to be reached:  @mobile - at his radio communications network telephone number FNB  @home - at his home number HNB in the fixed network  @partner - at his partner number PNB in the fixed network
home number HNB	fixed network telephone number for which credits are granted:  First alternative destination to radio

	communications network telephone number FNB in the fixed network
partner number PNB	Second alternative destination to radio communications network telephone number FNB in the fixed network
expiration@home	expiration date of home number HNB if service is not utilized
expiration@partner	expiration date of partner number PNB if service is not utilized
expiration@mobile	expiration date of radio communications network telephone number FNB if service is not utilized

In a further embodiment, the service is controlled via service telephone numbers. Depending on their reachability from the fixed network or from a radio communications network,

5      telephone numbers that are subject to different rates may be used.

A customer who is interested in participating in the service is registered for the service on service platform INP of the service provider in a one-time operation.

10     This registration process involves obtaining a clear assignment between a radio communications network telephone number FNB and a fixed network telephone number, denoted by home number HNB, of a subscriber B, which are jointly stored on service platform INP after successful completion of the

15     process.

The registration of an additional partner number PNB is available and may be optional.

It should be noted in this context that neither the radio communications network telephone numbers FNB nor the fixed network telephone numbers (HNB or PNB) may appear in an already existing assignment and that the participating fixed network telephone numbers must be switched at a fixed network provider participating in the service. In this exemplary embodiment, registrations can be made only from the fixed network home line. The number of the first fixed network line of subscriber B is home number HNB to be registered. This telephone number must not belong to a pay telephone.

In the following text, the registration procedure on service platform INP will be elucidated in greater detail using the example of a fixed network telephone number and a 0800 service telephone number.

- 15 To initiate the registration process, subscriber B dials an administration number 0800-Admin. The call is routed to service platform INP. This is implemented in accordance with the general IN architecture, by triggering a trigger point with respect to dialed service telephone number 0800.
- 20 Service platform INP routes the call to registration platform RP.

In a user dialogue with MFV input, a subscriber B who is interested in participating in the service must provide for his registration a radio communications network telephone number FNB that is to be linked to the fixed network telephone number of subscriber B (home number HNB). To check the allowed assignment between home number HNB, automatically detected by service platform INP, and radio communications network telephone number FNB entered by subscriber B and announced for confirmation purposes, registration platform RP transmits a PIN to the radio communications network telephone having radio communication telephone number FNB, the transmission taking

the form of an SMS. Within a specified waiting period, subscriber B must place another call from his fixed network line having assigned home number HNB to administration number 0800-Admin. The call is once again routed to registration platform RP via service platform INP. In a second user dialogue, subscriber B must enter the PIN received on his mobile radio communications network telephone. If the PIN is correct, the two telephone numbers, made up of fixed network number HNB and radio communications network telephone number FNB, may be entered as valid on service platform INP.

If no callback from the same fixed network line takes place within a specified waiting time, the pending registration process is erased. A later call using PIN input has no effect.

If the callback takes place in a timely manner but an incorrect PIN is entered repeatedly, the registration process begins anew.

After entering the valid PIN, the subscriber is offered the additional registration of a second fixed network telephone number, partner telephone number PNB. If the subscriber accepts the offer, this will be detected via an MFV dialogue and announced to the customer after completion of the input. Following confirmation by the customer, partner telephone number PNB is then likewise recorded in the particular database of service platform INP.

The status of the customer entry following registration is @Mobile. As a result, no call redirecting to the registered home or partner number takes place initially.

In addition to the registration, telephone number 0800-Admin is also used to delete registrations. Which specific business event is involved is revealed by the examination as to whether the number of calling subscriber B is already registered on

service platform INP as home number HNB. Accordingly, a user dialogue for one or the other business event is started on registration platform RP.

If, within the framework of the registration, the source 5 telephone number (home number HNB) or entered partner number PNB are telephone numbers from a fixed network that is not intended for the service, from a line (such as a pay telephone) not intended for the service, or from a radio communications network, an announcement takes place that the 10 service may basically be used only from the telephone numbers of the fixed networks that are integrated in the service. In order to be able to evaluate all cases, accessing of the port data of the fixed network lines and the signaling on the network is required.

15 In embodiments of the present invention, the service is activated by subscriber B himself, via a service telephone number. In the process, by means of a control call via a service telephone number, subscriber B initiates the redirecting of calls that arrive from the fixed network and 20 are destined for his registered radio communications network telephone number FNB, to a fixed network telephone number (home number HNB or partner number PNB) also registered to him, in whose vicinity he is currently located.

The switchover function to a fixed network terminal may be 25 triggered from the particular network on which subscriber B is currently located.

Two variants are possible in this context:

- a) from the fixed network, irrespective of whether reachability on the fixed network or on the mobile radio communications network is desired.
- b) from the mobile radio communications network,

irrespective of whether reachability on the fixed network or on the mobile radio communications network is desired.

Service telephone numbers, which, depending on their 5 reachability from the fixed network or radio communications network, may fall into different rate categories, may likewise be used to activate the switchover function, and thus to activate the service.

A description of the sequence for activating the redirection 10 of calls arriving from the fixed network to a fixed network telephone number of subscriber B will follow.

Using the fixed network or a radio communications network, subscriber B calls up the assigned service telephone number. A call treatment is requested on service platform INP. Service 15 platform INP determines source telephone number CgPNo of the calling subscriber within the framework of signaling. If source number CgPNo is able to be identified as radio communications network telephone number FNB, home number HNB or partner number PNB registered for the service, the corresponding status is set on service platform INP. All 20 further calls to the assigned radio communications network telephone number FNB are then handled according to the status. In the event that a status change was able to be implemented successfully, the call will be terminated by a network 25 announcement "The service feature is activated". If no change in the reachability status could be implemented, for example if source number CgPNo could not be identified on service platform INP, the connection will be terminated by a network announcement "Service or service feature not possible".

30 The present invention is explained in greater detail with the aid of an exemplary embodiment.

Using Fig. 1, the screening of the wire-wireless communication with optional redirecting to the fixed network following completed registration and service call to activate the call redirecting to the current fixed network terminal of subscriber B is described in greater detail.

The functional process sequence is as follows:

1. A fixed network customer, subscriber A, dials radio communications network telephone number FNB of a subscriber B.
- 10 2. Service switching function SSF triggers service platform INP via trigger detection point 3 (TDP3).
  - 3a. If the service is not activated, the incoming call will be forwarded to designated radio communications network telephone number FNB (status: @mobile).
  - 15 3b. If the service is activated, the incoming call will be redirected to the designated fixed network line, home number HNB (status: @home), or partner number PNB (status: @partner).

The call delivery to a fixed network line is permitted only if the call

- a) is made from a fixed network provided for this service; and
- c) source number CgPNo and redirection number RdgNo are not identical with the redirecting destination.

25 In all other cases the incoming call will not be incorporated in the service and forwarded to the designated radio communications network.

In embodiments, taking CgPNo and RdgNO into account in the service platform in connection with the stored redirecting destinations is unavoidable in order to prevent so-called circular routing.

5 By signaling a destination in the fixed network, the entry expiration@home or @partner (see table 1) is set ahead, for example, by two months after the current time. Signaling a destination in a radio communications network causes the entry expiration@mobile to be set  
10 ahead by, for instance, two months as well. If the current time reaches a set expiration date, complete erasure of a registration (at expiration@home, expiration@mobile), or only erasure of the optional entry of partner number PNB (expiration@partner), takes  
15 place in the registration. This method ensures that fixed network and mobile communications network numbers that are no longer reachable will be removed from the database of service platform INP.

If redirecting to the fixed network takes place, service  
20 platform INP initiates both monitoring of the call up to the end and also preparation of a communication data record KDS to determine the credit.

The call monitoring is advantageously implemented in the service switching function by which the triggering of  
25 service platform INP had been carried out.

Like other communication data records, communication data records KDS are collected from service switching function SSF and routed to billing service BS for processing.  
Communication data records KDS are relevant for any  
30 established communication connection, i.e., all connections redirected to the fixed network utilizing the service for

which a credit is to be provided. Communication data records KDS includes the following data, among others:

dialed telephone number	(radio communications network telephone number FNB of subscriber B)
fixed network telephone number subscriber A	(source of the call)
fixed network telephone number subscriber B	(HNB or PNB as destination)
fixed network telephone number HNB	(credit allocation)
starting time of the connection	(date/chronological time)
connection duration	(time)

All customer data records KDS for a fixed network customer  
5 that fall into a billing period are added up, recorded in a credit entry and taken into account in the telephone bill of the home line. This is advantageously done in such a way that the call minutes documented in communication data records KDS are assigned a negative price.

10 To facilitate the activation and deactivation of the switchover function, a device that allows an automatic activation of the service is provided at the location of the home and/or the partner number (HNB/PNB). The device is designed as switchover device in the form of a cradle for a  
15 mobile radio communications terminal in which the mobile

radio communications terminal of subscriber B, such as a mobile telephone, may be set down. This device is connected to the associated network termination device (TAE or NTBA, for instance) as additional fixed network terminal. By 5 placing the mobile radio communications network terminal (mobile telephone) in the storage depression of the cradle, a switch element in this location is actuated, which activates or deactivates the service via a programmed service telephone number for status changes. The switch element may be 10 configured as mechanical contact, for example. Two variants are provided for the device, one embodiment being configured for the interface connection to analog lines. The other embodiment is provided for ISDN lines and therefore programmable with respect to the MSN (multiple subscriber 15 number).

When the mobile telephone is picked up, the associated control call is triggered with a delay. The delay is meant to ensure that the status@mobile is activated immediately upon pick-up of the mobile telephone and corresponding activation 20 of the contact following a call from a fixed network (such calls are not redirected to the fixed network).

An additional, manually actuatable second switch element, which is located on the switchover device as well, triggers the direct and non-delayed calling of the programmed service 25 telephone number, and thus the control call. This specific embodiment is meant to allow an immediate switchover to mobile reachability instead of a delay when leaving the fixed network line. Display elements, which are disposed on the switchover device so as to be easy to see and preferably present in the 30 form of light-emitting diodes, indicate the possible switching states of the device. The customer is then able to identify his current reachability, either on the fixed network line or the radio communications network line.

Because of the reference to source number CgPNo, which is detected by service platform INP and utilized to determine the desired reachability status, the switchover device may be used both in the vicinity of home number HNB and/or partner number PNB.

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As an alternative, the device may also be equipped with a loudspeaker in order to ensure the acoustic reproduction of the announcements integrated in the network.

Furthermore, the device may also be configured as wireless embodiment in DECT/GAP standard for operation on analog and ISDN lines.

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